

NNWI FORUM 2019

# NUCLEAR ENERGY AS PART OF EUROPE'S ENERGY MIX



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# INTRODUCTION

We are delighted to be holding the first NNWI Forum 2019 and we are very grateful to EDF, our Lead sponsor, whose support has made this event possible, and to our Silver sponsor, CGN UK.

The Forum will focus on the theme “Nuclear energy as part of Europe’s energy mix”. It will be very timely as concern about the need to accelerate the world’s switch away from fossil fuels and their replacement with low carbon electricity generation technologies has mounted rapidly in the past twelve months.

The prospects for nuclear energy in Europe are uncertain. Despite the EU 2050 Energy Strategy’s ambitious greenhouse gas reduction targets the European Commission is ambivalent about the nuclear industry. Apart from France, Britain and Finland the only member states planning new plants are in central and eastern Europe.

The Commission’s attitude towards nuclear contrasts with its support for renewable energy. Nuclear is seen as competing against renewables. There’s a risk that the limit to which a modern economy can rely on intermittent energy sources is ignored - with worrying implications for security of supply.

The New Nuclear Watch Institute believes Europe needs both nuclear and renewable energy to meet its challenging targets. Cuts of 90 per cent in greenhouse gas emissions cannot be achieved by 2050 without a significant contribution from nuclear. Global concern about climate change will intensify in the next few years.

The Forum will address these issues directly. It will recognize that cost is an obstacle to faster development of new nuclear plant and examine how modern technology and practice can help. It will explore the economic benefits of developing new capacity.



## Yves DESBAZEILLE

Director General,  
FORATOM

Yves Desbazeille is French and graduated in electrical engineering from the Ecole Supérieure d'Electricité ("SUPELEC") in France in 1991 and studied on an MBA program in the early 2000s. During his successful career, he has been involved in different businesses and responsibilities at EDF: nuclear engineering, hydro and thermal power projects management in France, USA as well as in Asia, where he was for 5 years. His previous position as EDF representative for energy in Brussels has provided him with an in-depth knowledge of the EU institutions and Brussels' stakeholders and of the energy and climate stakes for Europe.

## Nuclear energy has a key role to play in Europe's low-carbon future. Here's why.

The European Union is currently in the midst of an important transition period. After the European Parliamentary elections, the new European Commission is being formed with Mrs. Ursula von der Leyen at the helm. On many occasions, Mrs. von der Leyen has underlined that one of her top priorities would be making Europe the world's first climate-neutral continent. Her plan aims at to reduce CO2 emissions by at least 50% by 2030. To this end, Mrs. von der Leyen has entrusted Frans Timmermans with the role of Executive Vice President for the "European Green Deal", which is touted to become "Europe's hallmark". Reviewing the way Europe produces electricity will be definitely one of Mr. Timmermans' main tasks.

What does it mean for nuclear energy?

Well, if the EU is serious about climate change, EU decision makers must make use of all the best tools available today. The "European Green Deal" has to be bold and far reaching, but it cannot ignore the contribution of low-carbon nuclear energy, which is capable of addressing EU climate and energy objectives. Without keeping the existing nuclear fleet in operation and adding new capacity, the EU won't reach these goals as having nuclear in the mix offers the only realistic pathway.

Nuclear energy offers many benefits that other solutions lack. It is a flexible and dispatchable source of energy, which reduces the environmental footprint of the power sector (air pollution, land, resource use). In addition, nuclear provides security of energy supply. A cost-effective energy transition will require a share of dispatchable nuclear generation that remains significant when the share of variable renewables increases. Finally, nuclear energy offers macro-economic improvements, as maintaining nuclear capacity has a positive impact on the economy (contribution to GDP, jobs, etc.).

Taking all these elements into account, the future of nuclear energy in the EU can look bright. In its 2050 long-term vision, the Commission has recognised the role nuclear energy has to play by describing it as the "the backbone of a carbon-free European power system, together with renewables". Now, we have to make sure that this approach is reflected in the policy files which have an impact on the shape of Europe's carbon-free future (which is not always the case), including the foreseen implementation of the "European Green Deal".

Without nuclear energy's contribution, the European Union would most definitely fall short of achieving its ambitious goals.



# Christopher GRANVILLE

Managing Director,  
TS Lombard

Christopher Granville is Managing Director for EMEA and Global Political Research at TS Lombard, an independent investment research firm formed in 2016 by the merger of Trusted Sources, an emerging market research provider which Christopher co-founded in 2006, and Lombard Street Research.

He has spent the greater part of his career as an analyst focused on the political economy and financial markets of Russia and other FSU countries, including six years as Chief Strategist and Political Analyst at United Financial Group (UFG), a Moscow-based investment bank that was acquired by Deutsche Bank in 2006. Christopher joined UFG from Fleming-UCB, where since 1995 he had held the position of Managing Director and Head of Research.

Prior to that, he was a UK diplomat, and served for four years in the political section of the British Embassy in Moscow. He was educated at Oxford University, where he was a Fellow of All Souls College.



# HINKLEY POINT C: BUILDING A LEGACY



## Dr Mark HARTLEY

**Technical Director,  
Hinkley Point C,  
EDF Energy**

Responsible for overall acceptance of the design to ensure it meets the UK requirements, taking a lead role in interfacing with the Office for Nuclear Regulation. In addition, he acts as an integrator across the project providing an authoritative view on the scope of engineering and safety case activities, while bringing together the process of managing overall change within the project.

He has over 20 years' experience in the nuclear industry and has held a number of Executive positions within the UK Nuclear Generation business. He was Chief Nuclear Officer responsible for operations of half the UK nuclear fleet. Prior to that he was Engineering Director responsible for all technical and engineering for the UK operating nuclear reactors.

Decarbonising the UK economy by moving away from gas and coal energy generation and towards a future powered by low carbon electricity is essential for the UK to tackle climate change.

Hinkley Point C, the new nuclear power station being built by EDF Energy and our partners, CGN, in Somerset, will produce low carbon electricity to meet 7% of UK need.

In June, the project reached its biggest milestone to date on schedule. The completion of the 49,000 tonne concrete base for the first of two reactors, known as "J-zero", paved the way for the construction of the above ground structure to begin.

The pouring of the final 9,000 cubic metres of concrete was the largest single concrete pour in the UK, surpassing the record set when The Shard was built in London.

The on-time completion of the first reactor base is the clearest indicator yet that delivery of the project is on schedule, including for connection to the grid by the end of 2025.

It's also an opportunity to take stock of the positive impact that Hinkley Point C is having locally.

The first new nuclear power station in the UK in a generation will create 25,000 job opportunities. Almost 4,500 people are now working on site, half of them from the local area giving a much-needed boost to the employment pipeline in the South West. The project will continue to provide long-term, well-paid jobs for local workers throughout the station's 60 year operational lifetime.

Added to this, EDF Energy's £15million investment in education and skills in the region is opening thousands of young people's eyes to opportunities for work in the nuclear industry. More than 450 apprentices have been trained by the project out of a total 1,000, starting them on the path to highly skilled careers in construction and engineering.

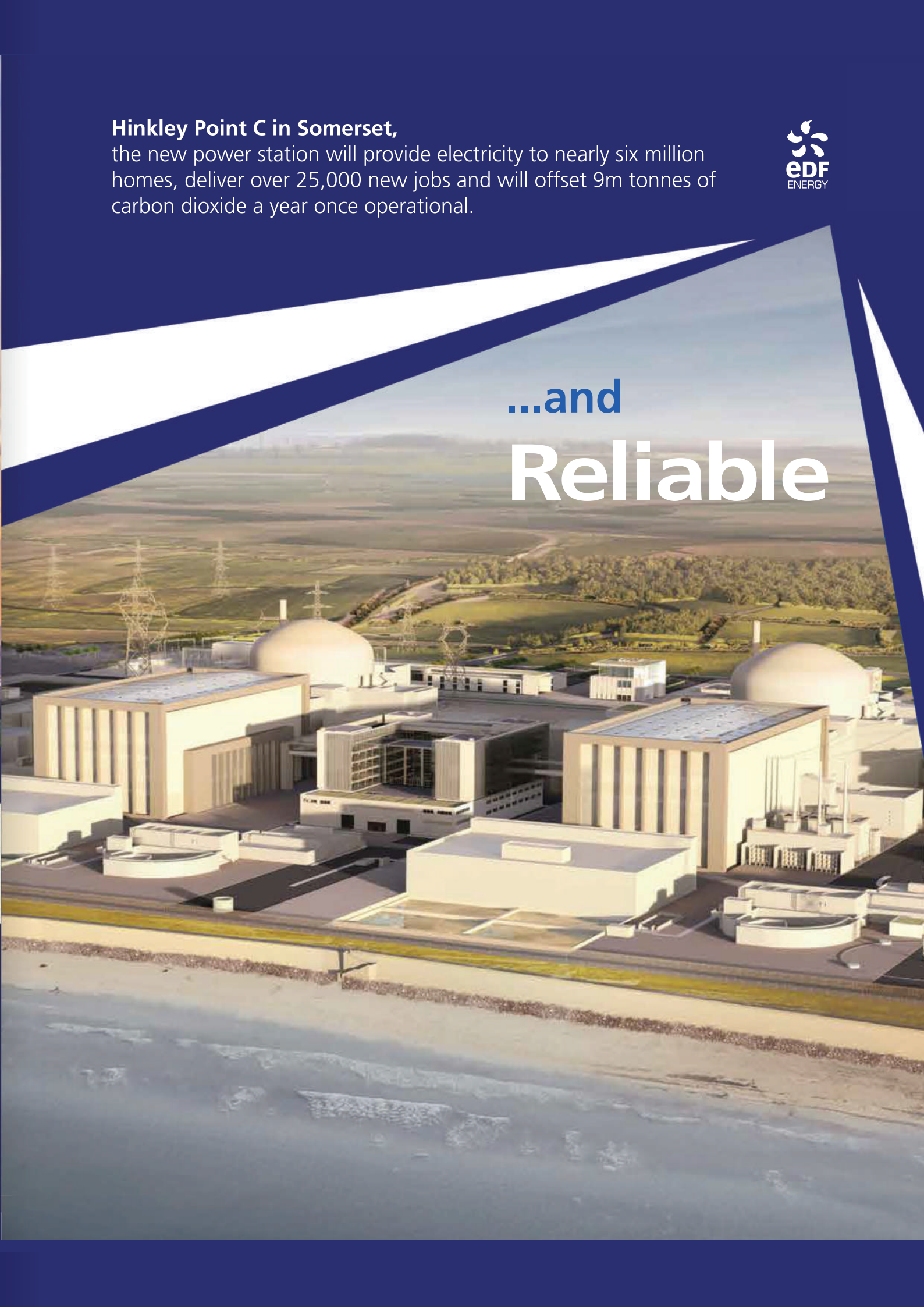
The opening of the region's new welding centre for excellence, a joint project between Hinkley Point C and its partners, including the local college, will help to address the national skills shortage within the industry. New low carbon generation projects across the UK will benefit from the next generation of welders trained at the centre.

And our commitment to supporting local industry means hundreds of businesses have already benefitted from the Hinkley Point C supply chain. Over £1billion worth of contracts have been awarded to firms from the region to date.

Hinkley Point C will leave a lasting legacy that will be felt by the local community long after construction has finished.



It's a combination of  
**Renewable...**



**Hinkley Point C in Somerset,**  
the new power station will provide electricity to nearly six million homes, deliver over 25,000 new jobs and will offset 9m tonnes of carbon dioxide a year once operational.



...and  
**Reliable**



**EDF Energy is the UK's largest producer of low-carbon electricity.**  
Our eight nuclear power stations and more than 30 windfarms avoid millions of tonnes of carbon emissions each year.

# A EUROPEAN GREEN NEW DEAL



## Tim YEO

**Chairman,  
The New Nuclear  
Watch Institute**

Tim is a graduate of Cambridge University. Before being elected to Parliament in 1983 he was CEO of the charity SCOPE.

He served in the government of Sir John Major as Minister of State at the Department of the Environment with responsibility for climate change, energy efficiency and the countryside. He was a member of the Shadow Cabinet from 1998 to 2005, Chairman of the House of Commons Environmental Audit Committee from 2005 to 2010 and Chairman of the Energy and Climate Change Select Committee from 2010 to 2015.

He has been Chairman of the New Nuclear Watch Institute and its predecessor New Nuclear Watch Europe since their launch in 2014. He has campaigned for three decades for faster action to tackle climate change and has promoted nuclear and other forms of low carbon energy.

He is a director of Getlink SE, operator of the Channel Tunnel, chairman of Waste2Tricity Limited and an adviser to the South Korea Ministry of Trade, Industry and Energy.

Not a day too soon a step change in international concern about climate change has occurred in 2019. It's just over a year since the IPCC warned of the dangers of a rise of more than 1.5 C in global average surface temperature.

During that time a variety of organisations - the International Energy Agency, the UN, the OECD and others - have emphasised the urgency of the need for drastic cuts in carbon emissions. Perhaps the most dramatic development has been the upsurge in public concern stimulated by young people like Greta Thunberg and reflected in support for movements like Extinction Rebellion.

Europe has been at the forefront of the world's response to the challenge of climate change for more than two decades, setting increasingly tough standards and targets.

Britain's scientists have raised public understanding of the issues and its policy makers have pioneered initiatives like legally binding carbon budgets and carbon emissions trading.

Despite these achievements far more must be done, and be done far more quickly, than ever before if dangerous irreversible climate change is to be avoided.

Today's Forum is about the role nuclear energy should play in this process. Its focus is on Europe and its message is applicable worldwide.

My contribution is A European Green New Deal. Green New Deals are becoming fashionable and pop up in varying guises with net zero targets often a prominent feature.

Setting targets is the easy part. It's widely accepted that, in the absence of cost effect carbon capture, fossil fuels must be

completely replaced for power generation, heat and cooling, and for surface transport. Common themes include the need for more energy efficiency and better demand side management.

There's less unanimity about what should replace fossil fuels. With the prospect of increasing use of electricity for transport and data processing the question of how electricity is generated is particularly urgent.

Time is not on our side. The world is fast approaching the safe limit for total greenhouse gas concentrations in the atmosphere.

I welcome unreservedly the expansion of renewable energy and the fall in the cost of solar and wind power. These trends will continue and renewables will supply a growing part of the world's energy.

But historically only two countries, France and Sweden, have ever cut carbon emissions in the past as fast as every country must do in future. Both did so by investing in nuclear power.

The New Nuclear Watch Institute therefore believes that nuclear energy is needed alongside renewables, for the next few decades at least. Both must be part of Europe's Green New Deal.



# PANEL CHAIRS



## Peter HALL

**Head of Nuclear Practice,  
Norton Rose Fulbright**

Peter has over 30 years of experience in the energy sector and is global head of our nuclear services group.

Peter has worked on nuclear projects for many years including in the UK as well as the Middle East, Europe and Asia. In the UK alone, he has advised on aspects of the Wylfa, Moorside and Hinkley Point C projects.

In relation to the proposed Regulated Asset Base model for financing new nuclear, Peter is ideally placed to advise as the new model will borrow heavily from the Thames Tideway Project on which he acted for the UK Regulator, OFWAT.



## Nick BUTLER

**Financial Times**

Nick Butler is visiting professor and chair of the Kings Policy Institute at Kings College London. He spent 29 years with BP, including five years as Group Vice President for Policy and Strategy Development at BP from 2002 to 2006. He has also served as Senior Policy Adviser at No 10, Chairman of the Centre

for European Reform and Treasurer of the Fabian Society. Nick is an investor in, and an adviser to a number of companies and institutions in the energy business.





# Adrian PEPPER

CEO,  
Pepper Media Group

Adrian Pepper has been providing opinion research and corporate communications advice through Pepper Media since 2002. He was previously a Special Adviser in Whitehall and a consultant at Chime Communications plc.

Pepper Media has advised on community, media and political relations for numerous real estate developments, including major infrastructure planning applications in the transport and energy sectors.

Adrian writes a regular column on politics for the Property Chronicle.

## Nuclear may be well established, but it needs to make a strong case

Atomic power has been with us in this country since Queen Elizabeth II switched on one of four magnox reactors at Calder Hall on 17 October 1956. Sixty-three years on, nuclear power accounts for a quarter of the UK's and a tenth of the world's overall power supply.

Back then, the public was deeply divided as to the merits of atomic energy, with many people concerned about its military applications, the environmental impact of waste disposal and potential accidents at the site. Over the subsequent decades, as it became increasingly apparent that the burning of fossil fuels was generating dangerous quantities of carbon dioxide, nuclear has come to be regarded as a climate-neutral source of energy.

The opinion research that the Pepper Media Group has undertaken over the past ten years in communities living close to nuclear power stations has revealed that most people buy into the arguments that nuclear energy prevents provides national energy security as well as stability of supply. Nuclear power is also extremely popular with local communities for the jobs and local spending that it supports.

The big question hanging over the industry is whether can produce power at the right price. Its detractors argue that, in a market with internationally mobile global capital, independent consortia should be able to

bring together enough investment in one place and invest in its future. There should be no need for governments to invest themselves, nor to underwrite or guarantee the price at which energy will be sold into the grid.

But no country's energy market is perfect. Governments and regulators always get involved in major infrastructure planning decisions, in strategic planning of the energy mix, in domestic energy prices and in decisions over how best to tackle the climate challenge. For the past 63 years, the nuclear industry has always been dependent on political backing.

In democracies, politicians keep a careful eye on the fluctuations of public opinion. It is not enough for the nuclear industry simply to make its case to the political and regulatory class. If nuclear is to have a long term future in the age of renewables, it must make the case to the public that it is already a source of green energy and that it too can provide new green energy jobs in the communities where they are most needed. Growth in the world's population will result in substantial increased energy demand over the coming decades. Nuclear will have make a strong case to be part of the new energy mix.



# Jeremy GORDON

**Director,  
Fluent in Energy**

Jeremy Gordon has enjoyed 15 years as a journalist and communication specialist in the energy industry specialising in nuclear power. His consultancy, Fluent in Energy, draws on a global network of experts, contacts and collaborators working for public understanding and for positive solutions to issues our society needs to face together.

## What are we here for?

In any endeavour it is important to be clear about your motivations – the reasons ‘why’ you do what you do. Keeping these needs, values and principles in mind will guide your decision making and maintain your drive to reach the goal, whether it be large or small. This clarity of purpose is especially important for very long timescale projects as well as any moments when you are forced to make compromises along the way.

As energy professionals we are clear that our highest priority is to provide the power and fuel that society needs on a daily basis, and, in addition, a small amount of headroom for growth and contingency. This ensures that people have the freedom to both live their lives and to efficiently get on with their chosen work.

Beyond those tangible needs some deeper reasons for excellence in the energy industry come into focus. Getting our work right in the energy sector means that society avoids a lot of problems, such as expensive imports of energy and fuel, as well as the insecurity that comes with relying too much on other jurisdictions. Low emission sources of power like wind, nuclear and solar decisively cut the pollution which would otherwise harm our health and further accelerate changes to the climate, which are already alarming.

Lastly, seeing as we have this method of generating electricity using nuclear reactors, there are specific benefits that come with using it. For example, nuclear facilities create longer lasting jobs, which on average are better paid and more highly skilled than those in most other industries. There are almost 64,000 of these desirable jobs for UK workers both inside the industry and in the ecosystem of manufacturing and services that support it, with around 7000 roles

coming available each year. Only a handful of countries have this depth of expertise. And at home, Oxford Economics and the Nuclear Industry Association believe each of those people adds £96,600 in gross value to the economy per year.

Prodigious innovation and optimisation in offshore wind technology have seen it scale up, cut costs and grow to deliver 17% of our electricity – and up to 30% on a good day. Solar has grown too and nuclear has stayed solid as a rock at around 20%. Along with gas they are seeing off coal and the UK is making progress towards a truly clean energy system. It’s fair to say the UK stands out as a developed country that is getting it right.

We have only to look California, which is comparable in energy consumption to the UK, to see the implications of getting it wrong. Failure to ensure fire safety around transmission lines has led to huge blackouts, leaving people with less capability to cope with fires which happened anyway. A small temperature rise there has increased the area susceptible to fire by a factor of eight.

Global average temperatures have already risen by 1°C from pre-industrial levels and show no signs of stopping. We are heading full speed into far bigger problems regarding our wellbeing than we’ve ever seen before. As an always-on supply of energy that enables our lives and our work, enhances our independence, and avoids worsening our environmental problems, nuclear stands to play a huge role underpinning whatever social and economic changes we devise – or are forced on us – in the coming century.

# IS THERE A PLACE FOR NUCLEAR ENERGY IN EUROPE?



## Costis STAMBOLIS

**Chairman and Executive Director, Institute of Energy for SE Europe (IENE)**

Costis Stambolis is a founding partner of the Athens based Institute of Energy for SE Europe (IENE) while he currently serves as Chairman and Executive Director. He also serves as a full member of the Greek government's standing committee on Energy and Climate Change (NECP). Costis has over forty years' experience in the broad energy sector having worked under various capacities on renewables (solar and wind), natural gas, energy market analysis and energy policy.

He holds graduate and postgraduate degrees from the Architectural Association in London and from the Said Business School at Oxford University. He is also the founder and managing editor of [Energia.gr](http://Energia.gr), Greece's foremost energy portal.

## Decarbonisation in South East Europe and the Role of Nuclear Power

In view of the very ambitious targets set by the European Commission for decarbonising power generation across Europe, and SE Europe in particular, which relies a great deal on coal and lignite for power generation, and the inadequate policies so far applied, it is highly debatable if the targets set for 2020 and the revised, even higher ones for 2030, let alone those of 2050, can actually be met.

By 2030, the EU has set a domestic GHGs reduction target to at least 40% below 1990 levels, along with the other main building blocks of the 2030 policy framework such as energy efficiency which must be improved by 32.5% by 2030. Whereas the share of renewables in the final EU energy consumption mix to reach at least 32%. Both targets are to be reviewed by 2023.

Latest thinking suggests that the EC will revise upwards these targets, while it is preparing to set even stricter limits for 2050. However, apart from the self-flagellatory element in EU's logic in its effort to curtail carbon emissions (which incidentally are falling steadily over the last decade), its current strategy, based entirely on the promotion of natural gas and Renewable Energy Sources (RES), backed by strenuous energy efficiency measures, lacks boldness of purpose and a clear view of market operation, especially with regard to the needs of adequate base load. But adequate base load is an absolute necessity if we are to achieve higher RES grid penetration.

In the case of SE Europe, in spite of EU's ambitious targets set for its member countries in the region and for those in the West Balkans under the umbrella of EU-funded Vienna-based Energy Community, progress towards decarbonization has been extremely slow to say the least, with a number of countries actually proceeding with the construction of new lignite fueled plants (e.g. Greece, Kosovo, Bosnia-Herzegovina and Serbia). These countries continue to view their energy future aligned with the continuing exploitation of their abundant indigenous coal resources which cover a substantial part of base load needs. Although there is ample EU support for large-scale use of RES and energy efficiency schemes, no such support or encouragement exists for the further use of nuclear generated power which could cover the region's growing energy requirements.

If the EU and the EC are serious in their quest of achieving much lower emission targets and eventually aim for carbon neutrality by 2050, they have to revise their policies with respect to nuclear power generation and hence include it as one of the main pillars of their long-term energy strategy.



# Rauli PARTANEN

**Science Writer and Analyst  
on Energy, Environment,  
Society & Economy  
Chief Executive Officer,  
Think Atom**

Rauli Partanen is an award-winning science writer and analyst on energy systems and the environment. He is also a frequent speaker at international climate and energy conferences. His book *Climate Gamble* (2015, with Janne M. Korhonen) has been translated to seven languages, and his latest book, “*Energian Aika*” (*The Age of Energy*), won the Science Book of the Year 2017 -award in Finland.

He co-founded and is currently leading Think Atom, an independent non-profit think tank which studies the potential of using nuclear to decarbonize different sectors of our energy use.

## Are We Finally Ready to Tackle Climate with Both Hands?

There has been no lack of stories, discussions and hashtags on the topic of climate urgency recently. And for good reason. Climate science’s message on the matter has been growing more and more serious, and ominous. For the last 30 years we have been talking about doing something, but not accomplishing that much. Emissions are still rising. Now our kids and grandkids are out there protesting and demonstrating to finally get something done.

It is safe to say that what we have been doing has not worked. Maybe we should finally try something that has worked? Nuclear power has played an integral role in the few decarbonization successes out there. Sweden, France, Switzerland, Belgium, Ontario, Finland, all have decarbonized their electricity systems to a level the rest of the world only dreams of achieving by mid-century, and they did it with a combination of nuclear power and renewable energy (mainly hydro).

Almost half of Europe’s clean electricity comes from nuclear. It is our only scalable source of both reliable and clean energy. Yet current EU level policies discriminate against it, and some EU countries do their utmost to shut it down and prevent others from using it.

With nuclear, the public discussion is often further from the facts than in almost any other subject. It sometimes feels like the majority of people were climate deniers – everyone is ignoring the science and finding excuses not to listen to it. I should know, I have written several books on the very topic. Too often those who claim to be the

most worried about climate change refuse to even allow, let alone support, nuclear energy. The arguments go in a roundabout of “it’s too dangerous”, “what about the waste”, “it’s too slow” and “it’s too expensive”. Drawing a perfect circular argument, too often the reason for people not to like it is “because people don’t like it”.

The thing is, these arguments are mostly false. Look at the science, bring context and do some reasonable comparisons, and you see that nuclear is our safest energy source, the waste has never hurt anyone and likely never will, it has been our fastest way to add low carbon energy and can be faster still if we let it, and that it is only expensive if not compared to other clean ways to provide a reliable energy service.

In truth, we need to make another energy turn. The Green New Deal, or whatever it ends up being called, needs not to just accept nuclear, although that is a good first step to take from where we are standing. It needs to embrace it in the same way as other low carbon energy sources and mitigation efforts are embraced. In all seriousness, how else can we build five times our current nuclear fleet, like the IPCC scenarios show we are likely to need?



# Dr Ben BRITTON

**FIMMM, CEng, CSci,  
Royal Academy of  
Engineering Research Fellow  
and Senior Lecturer,  
Imperial College London**

Dr Ben Britton is a Fellow of the Institute of Materials, Minerals and Mining, a Chartered Engineer and Chartered Scientist. He leads the experimental micromechanics group focus on understanding materials for extreme environments, and within the nuclear sector the group work extensively on nuclear plant and fuel cladding materials. At Imperial, he teaches about nuclear power, including new build, the existing fleet, and next generation reactors (both fission and fusion). He regularly speaks about a fossil free future and opportunities for nuclear power, especially within a UK and European context engaging with engineers, scientists, financiers, journalists, and the general public. He can also be found on twitter as @bmatb.

## A Reliable Future

There is only one reason to do the right thing – because it is the right thing to do.

The climate emergency is now. We need bold and brave people to make the right solutions possible. Nuclear projects are substantive, and long term investments, that will support decarbonisation and reduction of the impact of humans for this generation, and many generations to come.

At present, Europe generates 25% of its electricity from nuclear power. Germany still generates around 10%, with the UK producing 20% and France substantively more (~70%). If we explore countries that have managed to decarbonise their electricity supply, then we can notice a trend. The countries with good geography (e.g. Norway, Sweden) and relatively low population densities populations (i.e. high land mass / areas that can be flooded or covered with renewable technologies), and total population (i.e. low total electricity consumption) have managed to use renewables successfully. Otherwise, they have relied on nuclear (e.g. France). The UK teeters in the middle, with a progressive energy policy that is underpinned by an existing (but increasingly old, and thus close to retirement) nuclear fleet.

For us to continue with an energy rich society, which provides equitable solutions for substantive demographics of our population - nuclear power remains a proven and in reach solution for us to collectively step forward with. We can thus ask ourselves, as we reduce our unsustainable exploitation of fossil fuels, what limits us utilising nuclear in this vein?

Nuclear power technologies remain difficult to run economically, in part due to a lack of public trust (including senior politicians and major business leaders). This lack of trust

could be due to the industry being too forward in its engineering message – combined with a lack of empathy with what people truly engage with. How often do you hear a major nuclear engineering company harking about its safety message or the waste legacy? This does not mean that we should ignore safety, especially as an internal cultural issue, but when people have a truly emotive reaction to nuclear technologies, these messages provide easy methods of those who oppose nuclear power to erode trust.

For instance, the UN's reporting on prior major accidents demonstrably prove that nuclear power is safe enough - 93% of residents (both evacuees and still resident) in Fukushima had estimated does less than 2 mSv in the first six months post-accident. From our substantive understanding of radiation exposure, we expect this to result in no discernible health effects expected from this level of radiation. In fact, just living the UK this 'extra' exposure would be equivalent to your annual dose from background radiation.

In spite of this evidence, and talented scientists like my colleague Prof Geraldine Thomas talking to the highest level of government and the general public, we still hear takes of the “nuclear accident” at Fukushima placed out of context. Journalises and activists often forget that the annual ‘deathprint’ (i.e. deaths per trillion kWh) of global nuclear power is half of that of wind, one fifth of solar, and one 40th of gas.

The example I highlight here is a fraction of the story, I can share similar about the misrepresentation of the nuclear waste challenge. Both of these ideas however drive energy arguments away from nuclear power, despite our evident existential crisis about the future of planet earth as we know it. I note that nuclear power is not the only solution in this space, but it is one of our most important.

# MAKING THE CASE FOR NUCLEAR IN THE ENERGY MIX



## Peter FRASER

**Head of the Gas, Coal and Power Markets Division, IEA**

Peter Fraser is a Canadian national and has re-joined the International Energy Agency in December 2016 as Head of the Gas, Coal and Power Markets Division. This is his second sojourn with the IEA, having been a Senior Electricity Policy Advisor there from 1998-2004. In between, Peter worked at the Ontario Energy Board, the energy regulator in the Canadian province of Ontario, most recently as Vice President, Consumer Protection and Industry Performance. From 1989-98, he was an energy policy advisor at the Ontario Ministry of Energy.

Peter holds master's degrees in physics from Queen's University and in environmental studies from York University and a BSc in physics from the University of Toronto.

## Nuclear Power in a Clean Energy System

Nuclear power, along with hydropower, form the backbone of low-carbon electricity generation. Together, they provide three-quarters of global low-carbon generation. Over the past 50 years, the use of nuclear power has reduced carbon dioxide (CO<sub>2</sub>) emissions by over 60 gigatonnes – nearly two years' worth of global energy-related emissions. However, in advanced economies, nuclear power has begun to fade, with plants closing and little new investment made, just when the world requires more low-carbon electricity.

The presentation will cover the highlights of a recent IEA report, Nuclear Power in a Clean Energy System, the first such report the IEA has published on the topic in 18 years. The report focuses on the role of nuclear power in advanced economies and the factors that put nuclear power at risk of future decline. It is shown that without action, nuclear power in advanced economies could fall by two-thirds by 2040. The implications of such

a “Nuclear Fade Case” for costs, emissions and electricity security using two World Energy Outlook scenarios – the New Policies Scenario and the Sustainable Development Scenario are examined.

Achieving the pace of CO<sub>2</sub> emissions reductions in line with the Paris Agreement is already a huge challenge, as shown in the Sustainable Development Scenario. It requires large increases in efficiency and renewables investment, as well as an increase in nuclear power. This report identifies the even greater challenges of attempting to follow this path with much less nuclear power. It recommends several possible government actions that aim to: ensure existing nuclear power plants can operate as long as they are safe, support new nuclear construction and encourage new nuclear technologies to be developed.



## Dr Jonathan COBB

**Senior Communication  
Manager,  
WNA**

Dr Jonathan Cobb is the senior communication manager at World Nuclear Association. He coordinates the production of the World Nuclear Performance Report and contributes to the development of the Harmony programme. He manages the programme for the World Nuclear Association's annual symposium, the nuclear industry's leading global conference. He oversees the association's public website activities.

He began his career in the nuclear industry in 1994 at BNFL's Sellafield site, working on waste treatment and advanced reprocessing

R&D. He transferred to the commercial department to work on competitor analysis before moving to BNFL's head office, in the corporate strategy department, focusing on energy policy, climate change and sustainable development.

He joined World Nuclear Association in 2006. He continues to focus on climate change, representing the nuclear industry at many of the UNFCCC COP conferences.

## Making the Case for Nuclear in the Energy Mix

Global electricity demand is rising. Nearly a billion people lack access to electricity. Two billion more people will need electricity by 2050 as the global population expands.

It is fortunate then, that electricity is one of the few cornerstones of modern life where the practicality of a low carbon future has been demonstrated on a major scale. For it is clear, rapid and deep decarbonisation is the path we must follow.

Decarbonization is the new driver for growth in demand for electricity. Switching transport, heating and industrial processes from direct fossil fuel use to electricity will help reduce greenhouse gas emissions, provided low-carbon sources are used to generate it.

Clear too is that meeting the energy and environmental goals for electricity will be far harder without nuclear, and even if it were possible it would be far more expensive. The IEA's report "Nuclear Power in a Clean Energy System", launched in May this year, identified that a failure to invest in existing and new nuclear plant in advanced economies would have implications for emissions, for costs and for energy security.

Also this year, the World Energy Council concluded that nuclear energy is one of the most cost-effective sources of energy in many countries and that nuclear energy contributes to clean, low-carbon energy system stability, and this is not currently valued and compensated for.

For the period 2016-2020, the global nuclear industry is on track to double the rate of construction of nuclear plants compared to the average rate achieved over the previous 20 years. But that build rate will need to triple again to meet the industry's own Harmony goal of meeting 25% of global electricity demand before 2050. This is a practical goal, requiring an average build rate equal to that achieved during the mid-1980s.

But to meet the Harmony goal will require action to ensure a level playing field in electricity markets, harmonized regulatory practices and an effective safety paradigm. If these changes are made then the nuclear industry can play a key part in delivering a sustainable future for people and the planet.



# CUTTING THE COST OF NEW NUCLEAR PLANTS



## Alan RAYMANT

**Chief Executive,  
Bradwell B,  
CGN UK**

Alan Raymant is the Chief Executive of the Bradwell B project, which is taking forward the development of the planned new nuclear power station at the site in Essex. He joined CGN in January this year.

Alan set up Horizon Nuclear Power in 2009 as a UK joint venture between E.ON and RWE intended to develop, construct and operate new nuclear generation capacity at Wylfa and Oldbury. Horizon, which Alan led through the sale to Hitachi in 2012, was seen as a highly credible developer of new nuclear,

with an experienced team of more than 320 staff. Before Horizon his career had been spent in a variety of senior roles at Powergen and E.ON.

Alan has a Masters in Natural Sciences from the University of Cambridge, and an MBA from Warwick Business School. He is a Chartered Engineer and Fellow of the Institute of Engineering and Technology and of Institution of Chemical Engineers.

As the New Nuclear Watch Institute forum gathers in London we have to face a difficult truth: right now, nuclear is losing the battle when it comes to costs.

The £92.50 per MWh price agreed for Hinkley Point C reflected the fact that this was a first of a kind project. At the time it was significantly cheaper than offshore wind.

Since then much has changed. We have to admit to ourselves that the wind industry has done a great job in reducing costs and risks across the board. The strike price of £40 per MWh that was successful in the most recent CfD auction presents a huge challenge.

That challenge becomes even greater when we are told that the Hinkley Point C project will cost more than previously thought – and that the risk of delays has also increased.

All this means nuclear is all too often portrayed as a technology of the past.

We have to regain control of the debate and make clear the crucial role nuclear will play in a decarbonised world, supporting the electrification of transport and heating and the spread of artificial intelligence and the internet of things. We have to make clear that nuclear is a future technology, not something from the past.

And that means above all that we have to be clear that nuclear power stations built after HPC will be cheaper, and that if we build a fleet the costs will fall yet further over time.

CGN's experience as the world's biggest developer of new nuclear power stations suggests that building a fleet of reactors delivers these sorts of significant reductions in costs.

It enables the supply chain to mobilise and develop experience and skills, and so significantly reduces construction risks. That fleet effect works across borders too as CGN applies and shares learnings and experience from China to projects here.

Building a fleet of 4-6 HPR1000s in this country will see the capability of the supply chain here grow further, and as a result the cost of delivery fall.

That in turn can open up opportunities for domestic suppliers not just to work on the HPR1000 programme in the UK but also on the much larger programme in China.

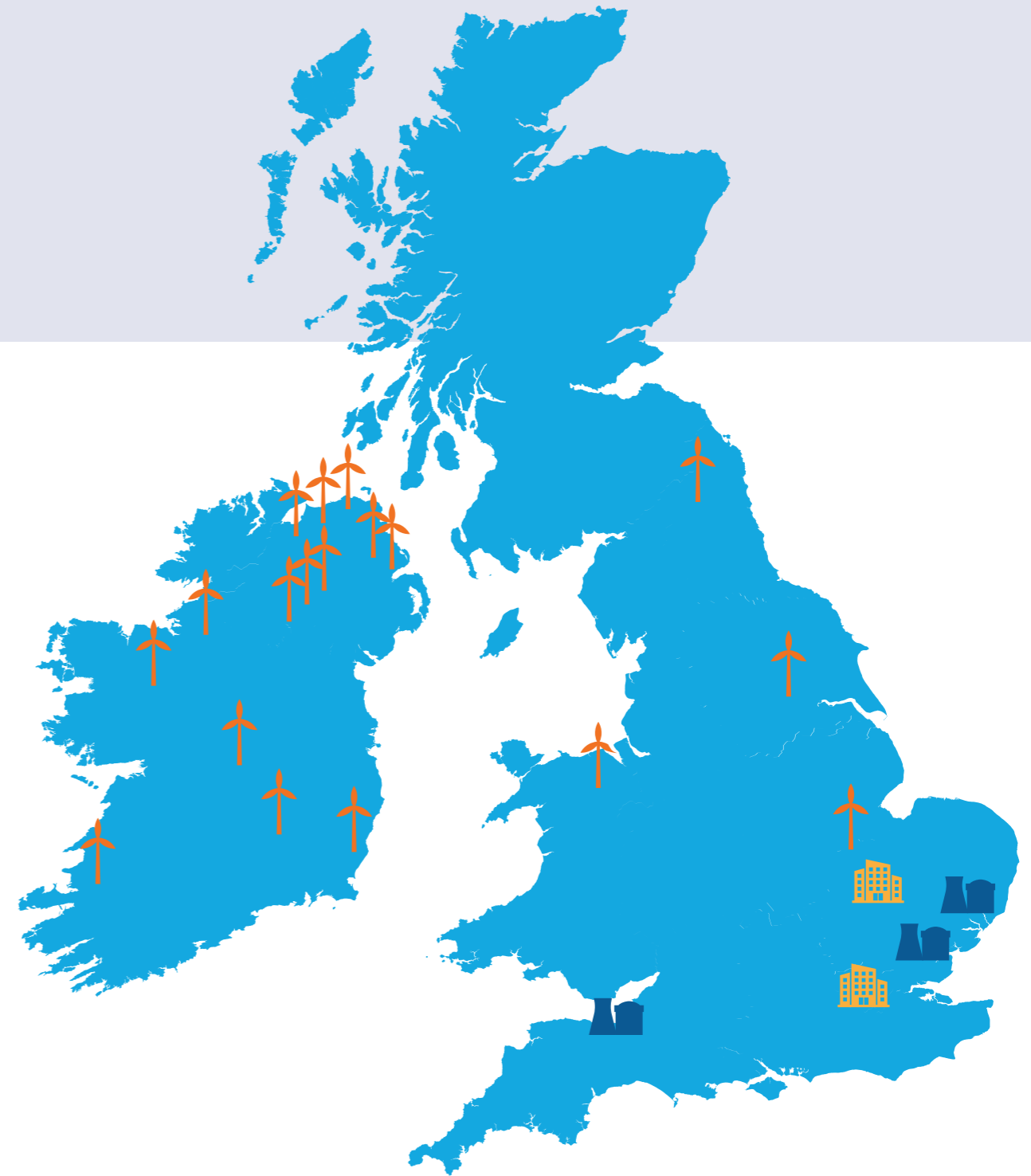
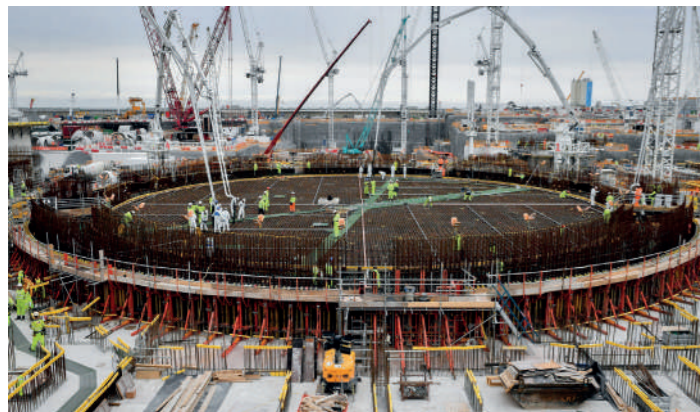
And all of this can ensure we have a competitive technology and a competitive supply chain. And enable nuclear to make its contribution to achieving carbon net zero by 2050.

CGN is the world's biggest developer of new nuclear power stations, and the third-biggest nuclear enterprise globally.



We are proud to bring our learning and experience from China to the UK in support of the **Hinkley Point C project**.

Subject to regulatory approval we are also planning to develop our HPR1000 reactor at **Bradwell B**.



 Windfarm  
(In operation)

 CGN Office

 Investments in nuclear  
(Under construction / planned)



# Kirsty GOGAN

**Executive Director,  
Energy for Humanity**

Kirsty Gogan, MSc. FRSA is founder and Global Director of Energy for Humanity (EFH) an environmental NGO focused on large scale deep decarbonisation and energy access. EFH led a delegation of the world's most highly regarded climate scientists to Paris COP21 in order to make the case for nuclear to be recognised as a vital part of the clean energy mix. EFH was subsequently shortlisted for the Business Green Leaders "Green NGO of the Year" Award in 2016 and received the US Nuclear Industry Council Trailblazer Award in 2019. At COP23, EFH published a new report on European Climate Leadership 2017 and presented a new study on Decarbonizing Cities with Advanced Nuclear. EFH jointly launched the Clean Energy Ministerial Flexible Nuclear Campaign in May 2019, supported by the Canadian, US, and UK governments and in partnership with US-based NGOs Energy Options Network and ClearPath Foundation. Kirsty is also the cofounding managing partner of LucidCatalyst, a consultancy

specialising in climate and energy, and recently commissioned by the UK Energy Technologies Institute to produce the widely-cited Nuclear Cost Drivers Study.

Kirsty is regularly invited as an expert speaker on science communication, nuclear competitiveness and innovation to high profile events around the world. She has 20 years' experience as a senior advisor to industry, non-profits and Government, including at 10 Downing St, the Office of the Deputy Prime Minister, and the Department of Energy and Climate Change, where she ran the national public consultation on nuclear new build, reviewed the national communications response to Fukushima and revised national guidance for civil nuclear emergency planning and response. Kirsty is also a member of the UK Government's Nuclear Innovation Research and Advisory Board (NIRAB) and chairs the cost-reduction working group.

## Can Nuclear Energy be a Competitive Climate Change Option Today?

### Lessons from Recent World Experience

by Eric Ingersoll, Andrew Foss, John Herter, Kirsty Gogan

LucidCatalyst, Energy Options Network, Energy for Humanity

To manage climate change, we need to reduce carbon dioxide emissions from the global energy system to near zero by mid-century. Meanwhile, global energy demand might double from current levels. All credible studies, including the IPCC, IEA and European Commission therefore conclude that nuclear energy should continue to play a significant role in a cost effective, timely and successful climate mitigation effort.

However, in light of high profile construction delays and cost overruns suffered by a handful of new nuclear projects in Europe and the USA, some argue that nuclear projects may be too expensive or slow to play a substantial role in decarbonizing the global energy system.

The truth is that the majority of nuclear projects around the world are being built today at a 50 to 80 percent lower capital cost, and almost twice as fast, as recent projects in the United States and Europe. At this cost level, nuclear is highly competitive with both fossil-fueled sources of electricity as well as many renewable sources.

Research by LucidCatalyst on behalf of the Energy Technologies Institute found that the gap between most and least expensive nuclear project costs is due principally to best in class industrial practice, labor productivity and a strategy to build the same design repeatedly, while maximizing learning between units. The cost reductions had very little to do with lower labor rates, build quality or rigor of safety regulation.

These best practices are not country-specific. They can be transferred globally and improved on to further reduce cost and build times. Indeed, historical examples of this include successful, and relatively low cost, nuclear new build programmes in the United States, as well as in Sweden and France when rapid deployment of nuclear largely, and rapidly, decarbonised electricity production.

A significant part of the higher costs can be indirectly traced back to inexperience and First-of-A-Kind (FOAK) projects. Building something for the first time or in a country for the first time (or after a prolonged pause) makes it very hard to implement best practices and high labor productivity – two of the big cost drivers according to our study – throughout the project.

Achieving cost reduction will require significant, internal transformation of the nuclear industry and this must be supported by public policy and continuing RD&D. While these cost reduction initiatives will not address all the barriers to global nuclear energy expansion, they will make nuclear a far more viable option for decarbonization, and as a result, our decarbonization efforts significantly more efficient.



# Humphrey CADOUX- HUDSON

**Nuclear Development  
Managing Director,  
EDF**

Humphrey studied Engineering and Management at Manchester University and worked at KPMG before joining Seeboard in 1991.

He was appointed Executive Director in May 2000 with responsibility for Seeboard's non-regulated businesses and group strategy and following Seeboard's acquisition by EDF Group in 2002, he was appointed Strategy and Development Director and later that year Chief Financial Officer and became a member of the Board.

After working on the £12.5bn acquisition of British Energy, in 2009 Humphrey was appointed Managing Director of Nuclear New Build leading the team that gained approval of the EPR design in the UK, and achieved financing of the Hinkley Point C project with EDF and Chinese partners CGN in 2016 and full mobilisation of construction.

In September 2017 Humphrey passed responsibility for the Hinkley Point Project to Stuart Crooks, Managing Director HPC, and took on the role of Managing Director Nuclear Development focussed on Sizewell C, Decommissioning of the AGR fleet, SMRs and EDF's involvement in Bradwell with partners CGN.

## Cutting the costs of new nuclear power plants

Cross party support to introduce a legally binding net zero emissions target by 2050 has cemented the UK's position as a leader in the fight against climate change. We now need to deliver it, with reductions in CO2 emissions from electricity production enabling reductions in heat and transport in a way that is affordable.

According to the Committee on Climate Change, the independent body preparing the UK against climate effects, we need to quadruple low carbon production in order to deliver 'net zero' by 2050, through a combination of 'intermittent' renewable sources alongside 'firm' low carbon generation.

UK government has confirmed its commitment to low carbon nuclear electricity on the basis that the cost can be reduced. We accept the challenge and we think it can be met.

Falling costs for future wind energy projects are good news for consumers. Britain will need a big expansion in renewables if it is to cut emissions to 'net zero'.

We also need electricity when the wind doesn't blow and the sun doesn't shine. Nuclear offers reliable, low carbon power to complement renewables and deliver an affordable system where the risks of intermittency are minimised.

Experience and repetition have enabled the offshore wind industry to drive down construction costs and the cost of financing construction. Studies show that the repetition effect also applies to nuclear. Countries building series of identical reactors

find they progressively become lower risk, and therefore cheaper to build and finance. That is already the experience at Hinkley Point C where we are building a UK version of the EPR reactor. Building the second of two identical units at Hinkley Point C is already proving faster and easier than building the first.

Hinkley Point C is the start of a pipeline of new nuclear projects that Britain needs to build. Our proposed project, Sizewell C, will be a close replica using the same design, workforce and supply chain. Evidence from the Energy Technologies Institute shows this is the best way to bring down the costs of building a nuclear power station.

The reduction in risk of building a repeat design lowers the costs of finance. The proposed regulated asset base funding model for Sizewell C widens the possible pool of investors by offering steady returns through construction into operation. Government published a consultation in June exploring how the model could be applied to nuclear development in June.

The twin effects of cheaper construction and cheaper finance mean the cost of building a new nuclear power station at Sizewell C can be competitive with the total costs of alternatives, even as low carbon electricity prices fall.

# ECONOMIC BENEFITS OF NUCLEAR



## Sue FERNs

Senior Deputy  
General Secretary,  
Prospect

Sue is Senior Deputy General Secretary at Prospect, the union for professionals.

Her responsibilities in Prospect include leading the union's work across the energy sector.

Sue is a member of the TUC General Council and Executive Committee, chair of the

Women's Committee and a TUC Aid Trustee. She is the TUC's lead on environment and sustainability.

Sue is Chair of Unions 21, a trade union think tank, and a Fellow of the Chartered Institute of Personnel and Development.

It is legitimate to expect our energy generators to provide good value for money for consumers, but we have been side-tracked into a narrow and sterile debate about price per MWh.

We need a more rounded debate about the costs of investment in energy infrastructure overall – including who pays for it – recognising that these can be very high, especially for trailblazer projects, but tend to reduce over time.

But the economic benefit of nuclear is much wider, especially in the communities where nuclear plants are typically located. On average EDF Energy's existing nuclear fleet each contribute around 13% of local gross value added (GVA), rising to close to 30% for Hinkley Point B. This means that on average nuclear power plants generate £1 out of every £8 of economic value in their local communities.

Similarly analysis by Oxford Economics shows that Sellafield contributes around £2.1Bn in GVA, accounting for approximately 59% of both GVA and employment in Copeland. These figures understate the true impact of these plants because they don't take account of the impact on the local economy of employees spending their wages. Neither do they take account of local supply chain activities. Around two thirds of Sellafield's total GVA derives from this broader positive economic benefit.

In addition, EDF Energy's six nuclear plants contribute between 7.5% and 45% of business taxes. This is particularly important in times of austerity and cuts to central government grants.

The UK nuclear industry is highly productive. GVA per job in nuclear generation is more than six times higher than the whole economy average and productivity across the Nuclear Decommissioning Authority Group is around 40% higher than the average.

A shift towards greater employment in high productivity sectors like nuclear will be central to closing the UK's productivity gap. Delivering the new build programme, and the jobs that go with it, could make an important contribution to this effort.

Finally, the UK will not achieve the net zero emissions target by 2050 without an energy policy that delivers investment in low-carbon infrastructure, including new nuclear. This is supported by analysis by the Committee on Climate Change, Cornwall Insight and the National Grid's Future Energy Scenarios. By contrast Germany, despite major investment in renewables, often generates at higher carbon intensity than either the UK or France because it relies so heavily on coal for back up.



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